What is so different about NGSS? – Earth Science

Activate Learning

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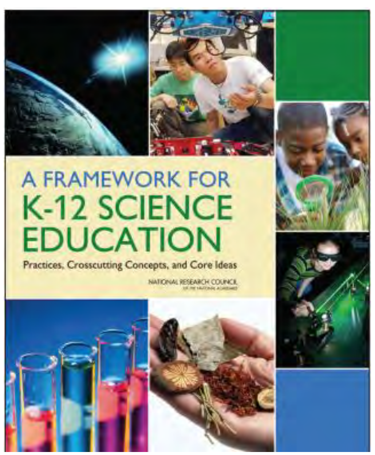

NEXT GENERATION SCIENCE STANDARDS
For States, By States

What will we do today?

- Learn a bit more about 3-Dimensiional learning
- Experience 3-Dimensional Learning
- Build understanding of Coherence
- Engage in doing a bit of science

NEXT GENERATION SCIENCE STANDARDS

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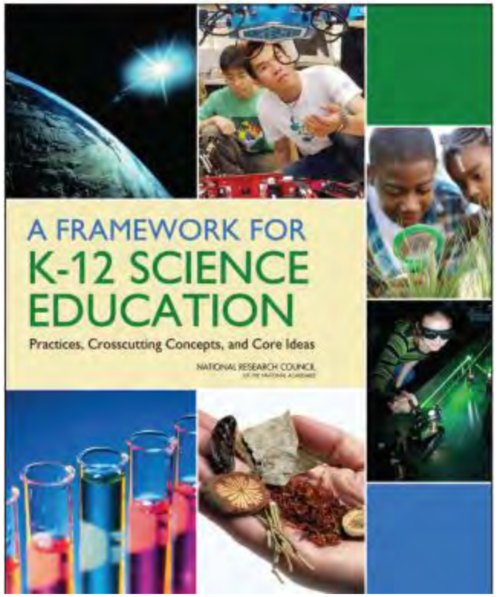
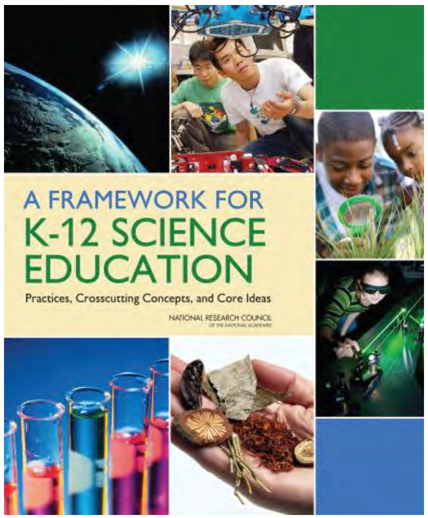


What's new in the Framework and NGSS?



NEXT GENERATION SCIENCE STANDARDS

1. Focus on explaining phenomena or designing solutions to problems
2. 3-Dimensional Learning
   1. Organized around disciplinary core explanatory ideas
   2. Central role of scientific and engineering practices
   3. Use of crosscutting concepts
3. Instructions builds towards performance expectations
4. Coherence: building and applying ideas across time

What is three 3-Dimensional Learning Learning

- Three-dimensional learning shifts the focus of the science classroom to environments where students use disciplinary core ideas, crosscutting concepts with scientific practices to **explore, examine,** and **explain** how and why phenomena occur and to **design solutions** to problems

Overview of EQuIP

I. Alignment to the NGSS	II. Instructional Supports	III. Monitoring student progress
1. Three dimensional: Supports students in three dimensional learning to make sense of phenomena or design solutions	Supports learning for all students through meaningful scenarios, supporting practices, supports phenomena and representations	Assessments evaluate three-dimensional learning; include formative; are accessible and unbiased
2. Coherence: Lessons fit together coherently, develops connections	Provides guidance for teachers to build coherence across the unit	Pre, formative, and summative aligned to three-dimensional learning

What should we look for in designing or deciding on materials?

The lesson/unit aligns with the conceptual shifts of the NGSS:

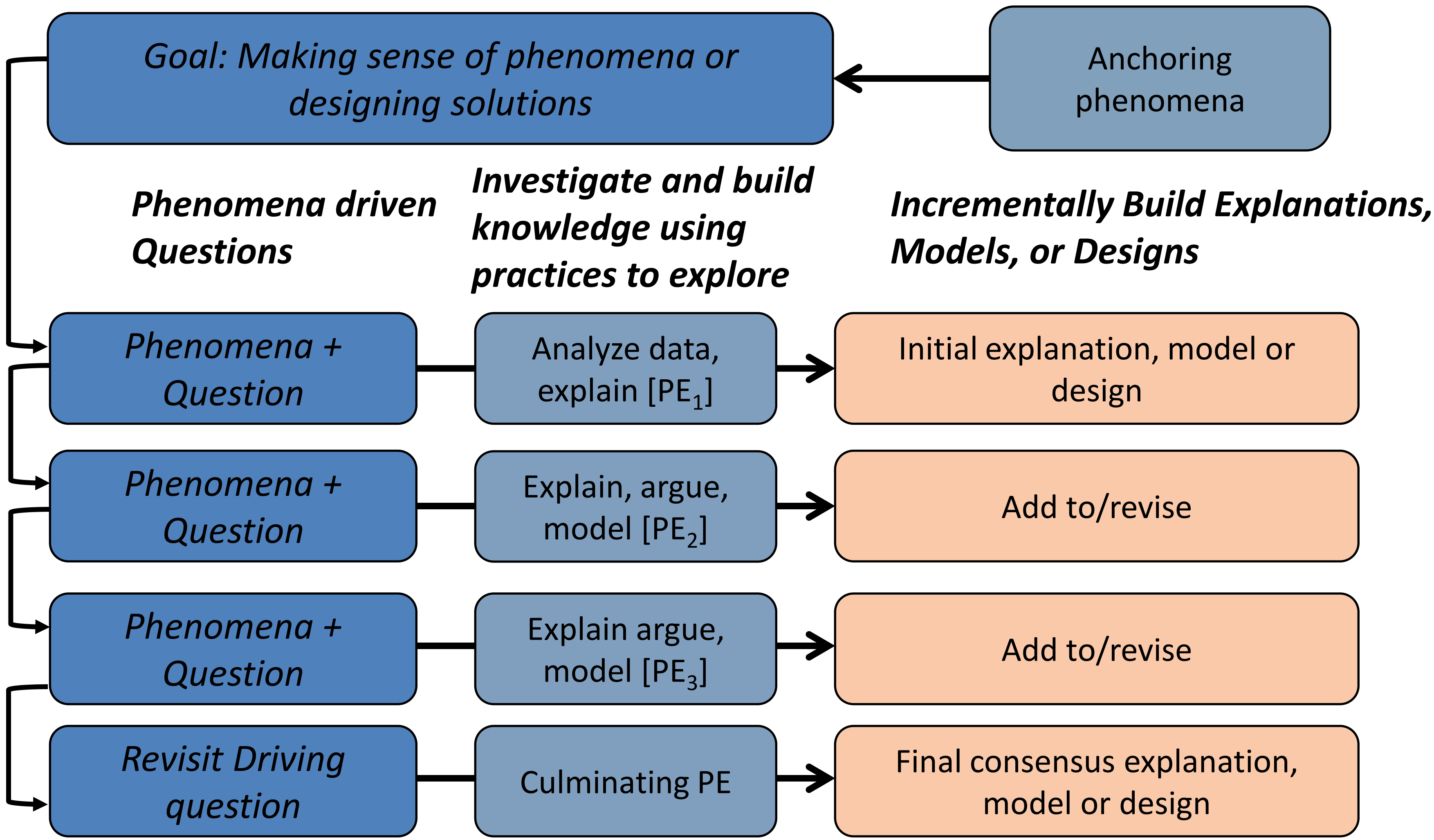
1. Elements of the science and engineering practice(s), disciplinary core idea(s), and crosscutting concept(s), blend and work together to support students in three-dimensional learning to make sense of phenomena or design solutions.

How do we move further? How do I support students in reaching a PE?

Driving question: How Does Water Shape Our World?

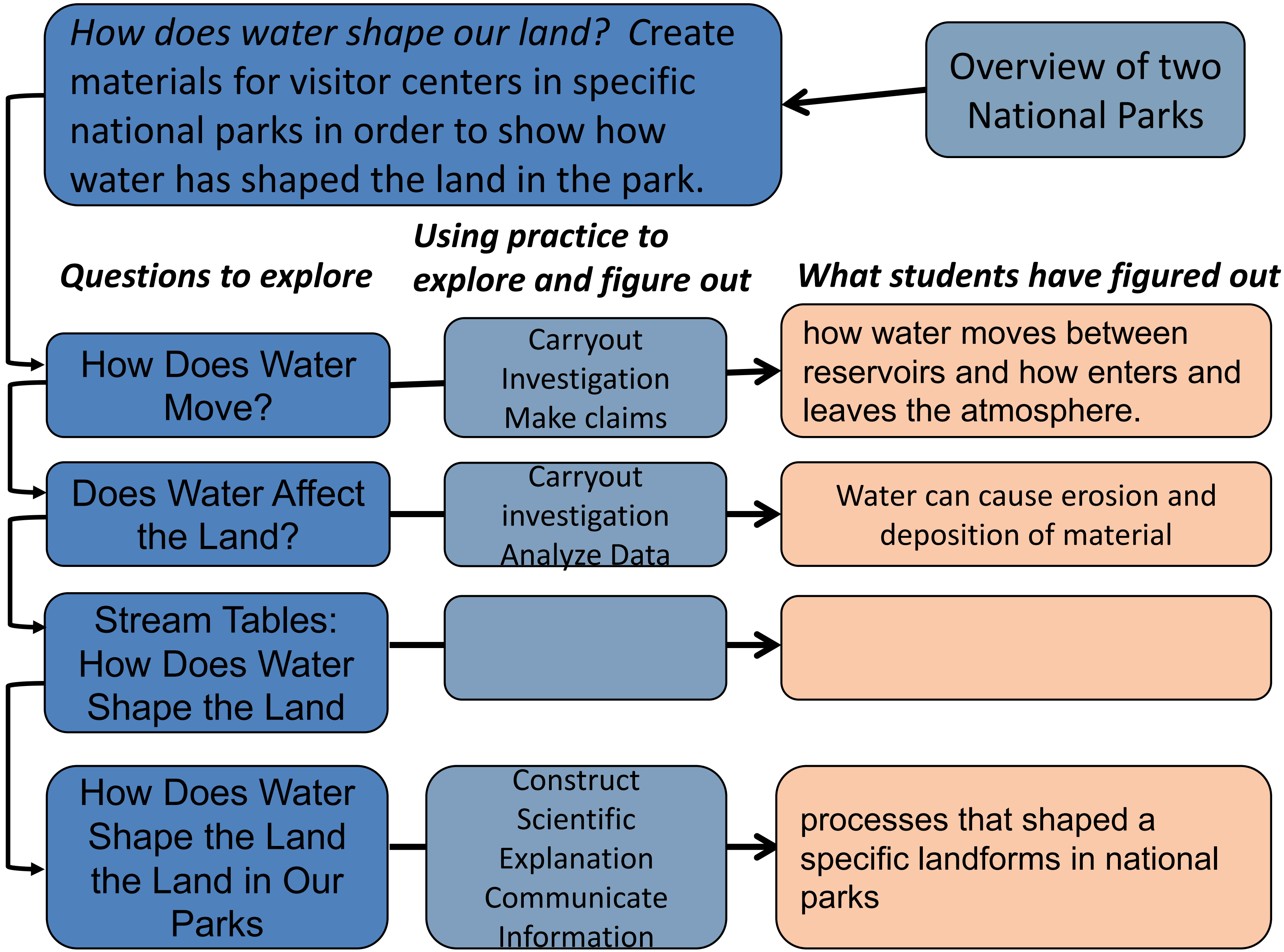
- A nine-week, project-based Earth Science unit.
- Students creating materials for visitor centers in specific national parks in order to show how water has shaped the land in the park.
- Students explore how water moves in the parks, what rock is present in the parks, and how water and rock interact.

Storyline: Question and phenomena motivate each step in building a disciplinary core idea



Thanks to Brian Reiser and Michael Novak

Driving Question: *How Does Water Shape Our World?*



Let’s engage in some phenomena!

What we know so far?

- Deposition
- Erosion

What are Scientific and Engineering Practices?

The multiple ways of knowing and doing that scientists and engineers use to study the natural world and design world.

The practices work together – they are not separated!

1. Asking questions and defining problems
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Developing explanations and designing solutions
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

Why Use Crosscutting Concepts?

Ideas that cut across and are important to all the science disciplines

Provide different lenses to examine phenomena

1. Patterns
2. Cause and effect
3. Scale, proportion and quantity
4. Systems and system models
5. Energy and matter
6. Structure and function
7. Stability and change

Build toward the following PE

MS History of the Earth

Students who demonstrate understanding can:

MS-ESS1-4. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. [Clarification Statement: Emphasis is on how processes change Earth's surface at time and spatial scales that can be large (such as slow plate motions or the uplift of large mountain ranges) or small (such as rapid landslides or microscopic geochemical reactions), and how many geoscience processes (such as earthquakes, volcanoes, and meteor impacts) usually behave gradually but are punctuated by catastrophic events. Examples of geoscience processes include surface weathering and deposition by the movements of water, ice, and wind. Emphasis is on geoscience processes that shape local geographic features, where appropriate.]

The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education

Scientific and Engineering Practices

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

- Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe nature operate today as they did in the past and will continue to do so in the future.

Disciplinary Core Idea

ESS2.A: Earth's Materials and Systems

- The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future.

ESS2.C: The Roles of Water in Earth's Surface Processes

- Water's movements—both on the land and underground—cause weathering and erosion, which change the land's surface features and create underground formations.

Crosscutting Concepts

Scale Proportion and Quantity

- Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.

Build toward the following PE

MS Earth's Systems		
Students who demonstrate understanding can: **MS-ESS2-1. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.** [Clarification Statement: Emphasis is on the processes of melting, crystallization, weathering, deformation, and sedimentation, which act together to form minerals and rocks through the cycling of Earth's materials.] [*Assessment Boundary: Assessment does not include the identification and naming of minerals.*]		
The performance expectations above were developed using the following elements from the NRC document A Framework for K-12 Science Education		
Scientific and Engineering Practices	Disciplinary Core Idea	Crosscutting Concepts
Developing and Using Models Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. ▪ Develop and use a model to describe phenomena.	**ESS2.A: Earth's Materials and Systems** ▪ All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms.	**Stability and Change** ▪ Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and processes at different scales, including the atomic scale.

How would EQuIP evaluate this lesson on three dimensional learning?

1. Elements of the science and engineering practice(s), disciplinary core idea(s), and crosscutting concept(s), blend and work together to support students in three-dimensional learning to make sense of phenomena or design solutions.
   a. Provides opportunities to use specific elements of the scientific or engineering practices(s) to make sense of phenomena or design solutions

Do the materials clearly point out how students use elements of the practice to make sense of phenomena or design solutions?

Poll

- Yes
- No

How would EQuIP evaluate this lesson on three dimensional learning?

1. Elements of the science and engineering practice(s), disciplinary core idea(s), and crosscutting concept(s), blend and work together to support students in three-dimensional learning to make sense of phenomena or design solutions.

   b. Provides opportunities to construct and use specific elements of the disciplinary core idea(s) to make sense of phenomena or design solutions

Do the materials clearly point out how students use elements of the DCIs to make sense of phenomena or design solutions?

Poll

- Yes
- No

How would EQuIP evaluate this lesson on three dimensional learning?

1. Elements of the science and engineering practice(s), disciplinary core idea(s), and crosscutting concept(s), blend and work together to support students in three-dimensional learning to make sense of phenomena or design solutions.

   c. Provides opportunities to construct and use specific elements of the crosscutting concept(s) to make sense of phenomena or design solutions

Do the materials clearly point out how students use elements of the crosscutting concepts to make sense of phenomena or design solutions?

Poll

- Yes
- No

Summary: Evaluating the focus on 3-dimensional learning

1. Elements of the science and engineering practice(s), disciplinary core idea(s), and crosscutting concept(s), blend and work together to support students in three-dimensional learning to make sense of phenomena or design solutions.

Poll
- Yes
- No

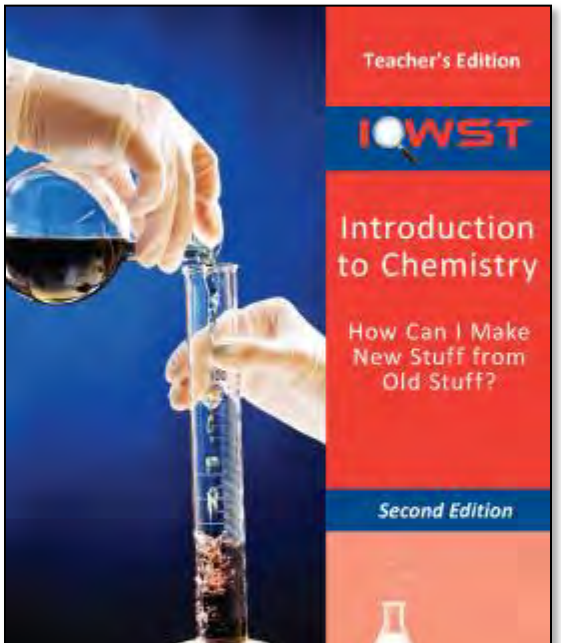
- Business is not the same!
- NGSS is different!
- Revolution and not evolution

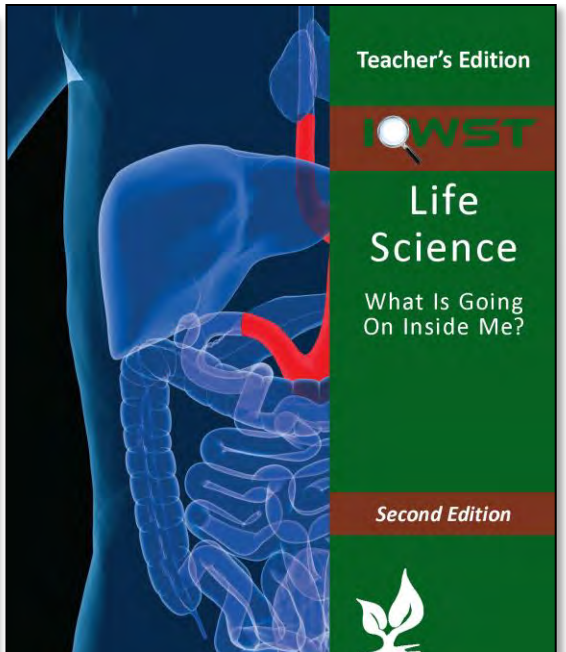
NEXT GENERATION SCIENCE STANDARDS
For States, By States

A concluding message

- By focusing on core ideas integrating with practices and crosscutting concepts, classrooms become learning environments where teachers and students have time to engage in science by designing and carrying-out investigations and making and debating claims supported by evidence and reasoning.

Thanks to!





Middle school curriculum materials supporting students using science practices to construct and apply disciplinary core ideas

IQWST: Investigating and Questioning our World through Science and Technology (Krajcik, Reiser, Sutherland, & Fortus, 2013)